



MAP2K1 gene

mitogen-activated protein kinase kinase 1

Normal Function

The *MAP2K1* gene provides instructions for making a protein known as MEK1 protein kinase. This protein is part of a signaling pathway called the RAS/MAPK pathway, which transmits chemical signals from outside the cell to the cell's nucleus. RAS/MAPK signaling helps control the growth and division (proliferation) of cells, the process by which cells mature to carry out specific functions (differentiation), cell movement (migration), and the self-destruction of cells (apoptosis). MEK1 protein kinase appears to be essential for normal development before birth and for survival after birth.

Health Conditions Related to Genetic Changes

cardiofaciocutaneous syndrome

At least 13 mutations in the *MAP2K1* gene have been identified in people with cardiofaciocutaneous syndrome. This condition affects many parts of the body, particularly the heart (cardio-), facial features (facio-), and the skin and hair (cutaneous). Each of these *MAP2K1* gene mutations changes a single protein building block (amino acid) in MEK1 protein kinase. These genetic changes abnormally activate the protein, which disrupts the tightly regulated RAS/MAPK signaling pathway in cells throughout the body. The altered signaling interferes with the normal development of many organs and tissues, resulting in the characteristic features of cardiofaciocutaneous syndrome.

Langerhans cell histiocytosis

lung cancer

Noonan syndrome

Noonan syndrome with multiple lentigines

At least one mutation in the *MAP2K1* gene has been found to cause Noonan syndrome with multiple lentigines (formerly called LEOPARD syndrome). This condition is characterized by multiple brown skin spots (lentigines), heart defects, short stature, a sunken or protruding chest, and distinctive facial features.

The identified *MAP2K1* gene mutation replaces the amino acid glutamic acid with the amino acid glycine at position 102 (written as Glu102Gly or E102G) in MEK1 protein

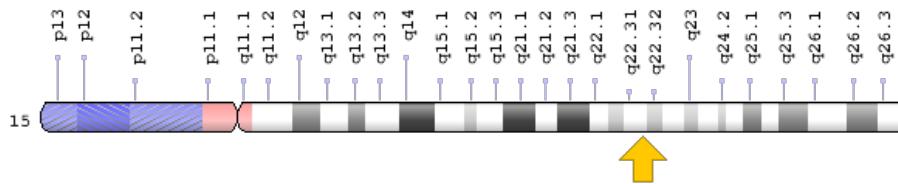
kinase. This change likely results in increased activation of the RAS/MAPK signaling pathway in cells throughout the body. The increased signaling interferes with the normal development of many organs and tissues, resulting in the characteristic features of Noonan syndrome with multiple lentigines.

It is unclear why the E102G mutation causes Noonan syndrome with multiple lentigines and other *MAP2K1* gene mutations cause different disorders, such as cardiofaciocutaneous syndrome (described above).

Chromosomal Location

Cytogenetic Location: 15q22.31, which is the long (q) arm of chromosome 15 at position 22.31

Molecular Location: base pairs 66,386,873 to 66,491,544 on chromosome 15 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- Dual Specificity Mitogen-Activated Protein Kinase Kinase 1
- ERK Activator Kinase 1
- MAP Kinase Kinase 1
- MAPK/ERK kinase 1
- MAPKK1
- MEK-1
- MEK-1 Protein Kinase
- MEK1
- MKK-1 Protein Kinase
- MKK1
- MKK1 Protein Kinase
- MP2K1_HUMAN

- PRKM1
- protein kinase, mitogen-activated, kinase 1 (MAP kinase kinase 1)

Additional Information & Resources

Educational Resources

- The Cell: A Molecular Approach (second edition, 2000): Ras, Raf, and the MAP Kinase Pathway
<https://www.ncbi.nlm.nih.gov/books/NBK9870/#A2252>

GeneReviews

- Cardiofaciocutaneous Syndrome
<https://www.ncbi.nlm.nih.gov/books/NBK1186>

Scientific Articles on PubMed

- PubMed
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28MAP2K1%5BTIAB%5D%29+OR+%28mitogen-activated+protein+kinase+kinase+1%5BTIAB%5D%29%29+OR+%28%28MAPKK1%5BTIAB%5D%29+OR+%28MEK-1%5BTIAB%5D%29+OR+%28MEK1%5BTIAB%5D%29+OR+%28MKK1%5BTIAB%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+360+days%22%5Bdp%5D>

OMIM

- MITOGEN-ACTIVATED PROTEIN KINASE KINASE 1
<http://omim.org/entry/176872>

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
http://atlasgeneticsoncology.org/Genes/GC_MAP2K1.html
- ClinVar
<https://www.ncbi.nlm.nih.gov/clinvar?term=MAP2K1%5Bgene%5D>
- HGNC Gene Family: Mitogen-activated protein kinase kinases
<http://www.genenames.org/cgi-bin/genefamilies/set/653>
- HGNC Gene Symbol Report
http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=6840

- NCBI Gene
<https://www.ncbi.nlm.nih.gov/gene/5604>
- UniProt
<http://www.uniprot.org/uniprot/Q02750>

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